

WHAT IS CLAIMED IS:

1. In a process for crosslinking a polyolefin polymer which includes grafting a silane material onto the polyolefin based polymer in the presence of a free radical generating initiator material, the improvement comprising:
 - 5 using an effective molar ratio of silane material to free radical of 40 or greater in the grafting reaction.
 2. The process of Claim 1 wherein the effective molar ratio of silane material to free radical is greater than 45:1.
 3. The process of Claim 1 wherein the effective molar ratio of silane material to free
10 radical is greater than 50:1.
 4. The process of Claim 1 wherein the free radical generating initiator material is a peroxide material.
 5. The process of Claim 1 further comprising contacting the grafted polyolefin material with moisture under conditions suitable for forming chemical linkages between at
15 least some silane moieties.
 6. The process of Claim 1 further comprising limiting the level of alkoxy radical moieties used in the grafting reaction to less than 500 micromoles per 100 grams of polymer.
 7. The process of Claim 1 wherein the polyolefin is spun into a fiber after the
20 grafting reaction but prior to any substantial crosslinking reaction.
 8. The process of Claim 1 wherein the polyolefin is a single-site catalyzed homogeneous polyolefin.
 9. The process of Claim 8 wherein the single-site catalyzed homogeneous polyolefin has a melt index from 1 to 10.
 - 25 10. The process of Claim 4 wherein the silane, peroxide and polymer are mixed thoroughly prior to initiating the grafting reaction.
 11. The process of Claim 1 wherein the grafting reaction is carried out using an extruder and the temperature profile of the extruder is maintained such that the silane peroxide and polymer are mixed thoroughly prior to initiating the grafting reaction.
 - 30 12. The process of Claim 1 wherein the grafted silane level is less than 3 percent by weight in the grafted polymer.

13. The process of Claim 1 wherein the grafted silane level is less than 2 percent by weight in the grafted polymer.

14. The process of Claim 1 wherein the silane material is described by the formula $R-Si-R'_3$, where R is an ethylenically unsaturated group, and R' is a hydrolyzable group.

5 15. The process of Claim 14 wherein the silane material is selected from the group comprising VTMOs and VTEOS.

16. The process of claim 4 wherein the peroxide material is 2,5-dimethyl-2,5-di(tert-butylperoxy)hexane.

17. The process of Claim 1 further comprising adding antioxidants.

10 18. The process of Claim 17 wherein the antioxidants are dry blended or melt blended with the polymer after the grafting reaction.

19. The process of Claim 1 wherein the polymer is additionally partially crosslinked using a method which does not involve silane grafting.

20. Partially crosslinked polymer made according to the process of Claim 1.

15 21. A fabricated article made from the crosslinked polymer of Claim 20 wherein the article is selected from the group consisting of film, fiber, foam, molded article and wire and cable coating.

22. The fabricated article of claim 21 wherein the article is a multilayer film.

20 23. The fabricated article of claim 21 wherein the article is a fiber selected from the group consisting of monofilament fibers, multifilament fibers, staple fibers, bicomponent fibers and biconstituent fibers.

24. The fiber of claim 23 wherein the fiber is a covered fiber.

25 25. The process of Claim 1 wherein the polyolefin material has a melt index after grafting which is no lower than 80 percent of the melt index of the polyolefin material prior to grafting.

26. The process of Claim 1 wherein the polyolefin material has a melt index after grafting which is no lower than 90 percent of the melt index of the polyolefin material prior to grafting.

30 27. A method of forming a silane crosslinked polyolefin polymer in the shape of a fiber comprising the steps of:

(a) contacting a polyolefin polymer with a silane material in the presence of a free radical initiating species under conditions sufficient to allow at least a portion of the silane

material to become grafted onto the polyolefin polymer and wherein the effective molar ratio of silane material to free radical is at least 40 or greater;

(b) spinning the silane-grafted polyolefin polymer obtained from step (a) into fibers;

(c) applying a material to the fiber which is capable of catalyzing a hydrolysis
5 reaction between the silane moieties grafted to the polymer and moisture; and

(d) contacting the fiber with moisture under conditions sufficient to promote a crosslinking reaction.

28. The method of claim 27 wherein the silane grafted polyolefin polymer is spun into fibers at line speeds of at least 300 meters per minute.

10 29. The method of Claim 27 wherein the polyolefin polymer has a starting melt index between 2.5 and 10.

30. A fiber made from the process of Claim 27 wherein the fiber has a tenacity of at least 0.6 gm/denier and an elongation to break of at least 400 percent.

31. A woven or knitted article comprising fiber made from the process of Claim 27.

15 32. A non-woven web comprising fiber made from the process of Claim 27

33. The method of Claim 27, wherein step c is accomplished using a spin finish applicator

34. The method of Claim 33 wherein the material capable of catalyzing the hydrolysis reaction is first mixed with a spin finish for the fiber.

20 35. The method of Claim 27 wherein the material capable of catalyzing the hydrolysis reaction is a zirconate or titanate compound.

36. The method of Claim 35 wherein the material capable of catalyzing the hydrolysis reaction is titanium (IV) bis(acetylacetonate) diisopropoxide; titanium (IV) tetrakis(2-ethyl-1,3-hexanediolate); or [2,2-bis[(2-propenyloxy)methyl]-1-butanolato-
25 O,O',O'']tris(neodecanoato-O)zirconium.

37. A method of forming a silane crosslinked polyolefin polymer in the shape of a fiber comprising the steps of:

(a) contacting a polyolefin polymer with a silane material in the presence of a free radical initiating species under conditions sufficient to allow at least a portion of the silane
30 material to become grafted onto the polyolefin polymer;

(b) spinning the silane-grafted polyolefin polymer obtained from step (a) into fibers;

(c) applying a material to the fiber of step (b) which material is capable of catalyzing a hydrolysis reaction between the silane moieties grafted to the polymer and moisture; and

(d) contacting the fiber with moisture under conditions sufficient to promote a crosslinking reaction.

- 5 38. The method of Claim 37 wherein the effective molar ratio of silane material to free radical used in step (a) is at least 40 or greater.